

# Zero Rate Curve





## Zero Curve

### Zero Curve

- Zero rate curve is defined as the relationship between the yield-to-maturity on a zero coupon bond and the bond's maturity.
- Zero rate curves can be derived from OIS, LIBOR, or swap instruments.
- The OIS, LIBOR, swap term structure is a robust tool for pricing and hedging financial products.



## zero Curve

### Zero Curve (Cont.)

- Swap term structure a more efficient hedging and pricing vehicle.
- Swap markets are more liquid and efficient than government debt markets.
- Zero curves constructed from the most liquid interest rate instruments have become the standard funding curves in the market.
- The 3 month LIBOR curve is the base zero curve in the market.



## zero Curve

### Zero Curve (Cont.)

- The term structure of zero rates is constructed from a set of market quotes of some liquid market instruments.
- People used to perform valuation and risk management using a single-curve approach. This approach consisted of building a unique curve and using it for both discounting and forecasting cashflows.





## zero Curve

### Zero Curve (Cont.)

- However, after the financial crisis, basis swap spreads were no longer negligible and the market was characterized by a sort of segmentation. Consequently, market practitioners started to use a new valuation approach referred to as multicurve approach, which is characterized by a unique discounting curve and multiple forecasting curves
- The zero term structure is increasingly used as the foundation for deriving relative term structures and as a benchmark for pricing and hedging.



## zero Curve

# Zero Curve Construction

- Zero curves are derived or bootstrapped from OIS, LIBOR, swap curve.
- Normally the curve is divided into three parts. The short end of the term structure is determined using LIBOR rates. The middle part of the curve is constructed using Eurodollar futures or forward rate agreements (FRA). The far end is derived using mid swap rates.
- The objective of the bootstrap algorithm is to find the discount factor for each maturity point and cash flow date sequentially so that all curve instruments can be priced back to the market quotes.



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### Interpolation

- Most popular interpolation algorithms in curve bootstrapping are linear, log-linear and cubic spline.
- The selected interpolation rule can be applied to either zero rates or discount factors.
- Some critics argue that some of these simple interpolations cannot generate smooth forward rates and the others may be able to produce smooth forward rates but fail to match the market quotes.
- Also they cannot guarantee the continuity and positivity of forward rates.



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# Optimization

- As described above, the bootstrapping process needs to solve a zero using a root finding algorithm.
- In other words, it needs an optimization solution to match the prices of curve-generated instruments to their market quotes.
- FinPricing employs the Levenberg-Marquardt algorithm for root finding, which is very common in curve construction.
- Another popular algorithm is the Excel Solver, especially in Excel application.





# Thank You

Reference:

<https://finpricing.com/lib/EqRainbow.html>